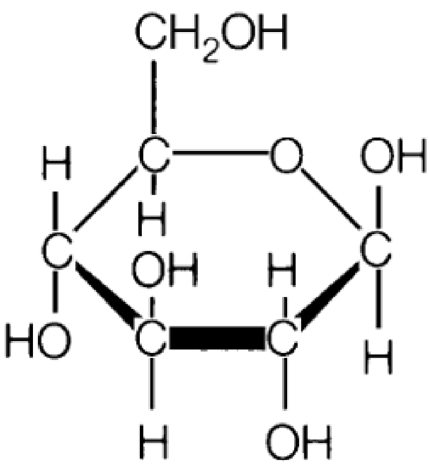
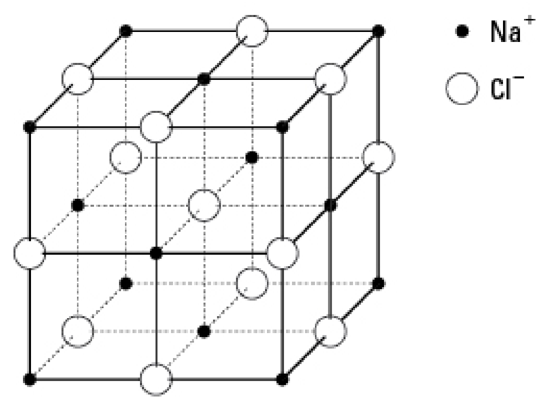
Chemistry I

Final Examination
Reference Materials





DO NOT WRITE IN THIS BOOKLET

Miscellaneous

1 mole= 6.02 x 10^{23} representative particles = 22.4 liters (for a gas at STP) = molar mass

$$\%Error = \left(\frac{\left|\text{experimental value-accepted value}\right|}{\text{accepted value}} \right) \times 100$$

$$\%yield = \left(\frac{\text{actual mass of product}}{\text{predicted mass of product}} \right) \times 100$$

Celsius + 273 = Kelvin

1 atm = 760 mmHg = 760 torr = 101.3 kPa = 14.7 psi

1 Liter = 1000 milliliters

1 milliliter = 1 cm^3

$$\#\text{mol} = \frac{\#\text{g}}{\text{mm}} \qquad \#\text{L} = \frac{\#\text{mL}}{1000} \qquad \#\text{ kg} = \frac{\#\text{ g}}{1000}$$

Gas Laws

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \qquad P_1V_1 = P_2V_2$$

$$\frac{(P_1V_1)}{T_1} = \frac{(P_2V_2)}{T_2} \qquad \frac{V_1}{n_1} = \frac{V_2}{n_2}$$

$$d = \frac{(P)(mm)}{(R)(T)}$$

$$PV = \frac{gRT}{MW} \qquad PV = nRT$$

$$\frac{R_a}{R_b} = \frac{\sqrt{mw_b}}{\sqrt{mw_a}}$$

Selected Universal Gas Constants (R):

$$0.082\,\frac{\text{L-atm}}{\text{mol-K}} \qquad 62.4\,\frac{\text{L-mmHg}}{\text{mol-K}}$$

$$82\,\frac{\text{mL-atm}}{\text{mol-K}} \qquad 62360\,\frac{\text{mL-mmHg}}{\text{mol-K}}$$

Pressure Units Equivalences: This is standard pressure in different units.

1 atmosphere (atm)	14.7 lbs/ in^2	101.33 kPa
760 mm of Hg	760 Torr	1013.25 millibars
29.92 inches of Hg	0.760 meters of Hg	76 cm of Hg

Vapor Pressure of Water at Various Temperatures

Temp	Pressure		
(^{o}C)	mm Hg	atm	kPa
0	4.6	0.006	0.61
5	6.5	0.009	0.87
10	9.2	0.012	1.23
15	12.8	0.017	1.70
16	13.6	0.018	1.82
17	14.5	0.019	1.94
18	15.5	0.020	2.06
19	16.5	0.022	2.20
20	17.5	0.023	2.34
21	18.6	0.025	2.49
22	19.8	0.026	2.64
23	21.1	0.028	2.81
24	22.4	0.029	2.98
25	23.8	0.031	3.17
26	25.2	0.033	3.36
27	26.7	0.035	3.56
28	28.3	0.037	3.78
29	30.0	0.040	4.00
30	31.8	0.042	4.24
31	33.7	0.044	4.49
32	35.7	0.047	4.76
33	37.7	0.050	5.03
34	39.9	0.053	5.32
35	42.2	0.056	5.62
36	44.6	0.059	5.94
37	47.1	0.062	6.28
38	49.7	0.065	6.62
39	52.4	0.069	6.99
40	55.3	0.073	7.38
45	71.9	0.095	9.58
50	92.5	0.122	12.33
55	118.0	0.1553	15.74
60	149.4	0.1965	19.92
65	187.5	0.247	25.00
70	233.7	0.308	31.16
75	289.1	0.380	38.54
80	355.1	0.467	47.34
85	433.6	0.571	57.81
90	525.8	0.692	70.09
95	633.9	0.834	84.51
100	760.0	1.00	101.33

Solutions

Percent solution

$$\% \text{ solute} = \frac{\#\text{g solute}}{\#\text{g solution}} \times 100\% \qquad \% \text{ solvent} = \frac{\#\text{g solvent}}{\#\text{g solution}} \times 100\%$$

Molarity

$$\text{M} = \frac{\text{mol.}(\text{solute})}{\text{L}(\text{solution})} \qquad \text{M} = \frac{\left(\frac{\#\text{g}}{\text{mm}}\right)}{\text{L}(\text{solution})}$$

Molality

$$\text{m} = \frac{\text{mol.(solute)}}{\text{kg(solvent)}} \qquad \text{m} = \frac{\left(\frac{\#\text{g}}{\text{mm}}\right)}{\text{kg(solvent)}}$$

Henry's Law

$$\frac{C_1}{P_1} = \frac{C_2}{P_2}$$

Freezing point & boiling point for water

$$\Delta \text{T}_f = (\text{m})\left(\frac{1.86^{\circ}\text{C}}{1\text{ m}}\right)(\#\text{particles}) \qquad \Delta \text{T}_b = (\text{m})\left(\frac{0.512^{\circ}\text{C}}{1\text{ m}}\right)(\#\text{particles})$$

$$\text{fp}_{new} = \text{fp}_{orginal} - \Delta \text{T}_f \qquad \text{bp}_{new} = \text{bp}_{orginal} + \Delta \text{T}_b$$

pH & pOH

$$\text{pH} = -\log\left[H^+\right] \qquad \left[\text{H}^+\right] = 10^{-\text{pH}} \qquad \text{pH} + \text{pOH} = 14$$

$$\left[\text{H}^+\right]\left[\text{OH}^-\right] = 10^{-14} \qquad \text{pOH} = -\log\left[\text{OH}^-\right] \qquad \left[\text{OH}^-\right] = 10^{-\text{pOH}}$$

Titration

Stoichiometric approach:

$$(\#\text{H's})(\text{M}_{acid})(\text{volume}_{acid}) = (\#\text{OH's})(\text{M}_{base})(\text{volume}_{base})$$

Rules for assigning oxidation numbers.

1. 1. The algebraic sum of the oxidation numbers of ALL of the atoms in a compound MUST equal zero.
2. An uncombined element (free element) has an oxidation number of zero (0).
3. A monatomic ion has an oxidation number equal to its charge.
4. Fluorine's oxidation number is –1 in all compounds.
5. Oxygen has an oxidation number of –2 in all compounds.
6. Hydrogen has an oxidation number of +1 except when combined with metals.
7. All Group 1 elements will have a +1 oxidation number. All Group 2 elements have a +2 oxidation number. Aluminum will always be +3.
8. Second element in a binary compound is assigned the oxidation number it would have if it were an ion.
9. The algebraic sum of the oxidation numbers of ALL atoms in a polyatomic ion is equal to the charge of the ion.